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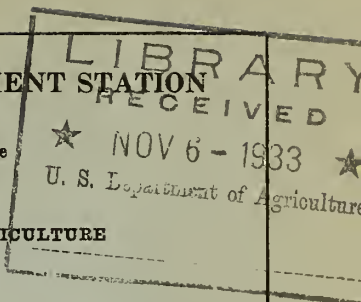
HONOLULU, HAWAII

Under the joint supervision of the
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CANE MOLASSES IN POULTRY RATIONS

BY

C. M. BICE, Poultry Husbandman



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CANE MOLASSES IN POULTRY RATIONS

BY

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INTRODUCTION

Cane molasses, which is a cheap and abundant by-product of sugar manufacture, the leading industry of Hawaii, has been proposed as an economical substitute for part of the usual grain-mixture feeds shipped in from the mainland.

Molasses is well liked by all kinds of farm animals. Henry and Morrison¹ state that when fed in moderate amounts it is about equal to corn, pound for pound, for fattening. Winter² reports that cane molasses is mildly laxative and that it should not be used to a greater extent than 10 percent in rations for laying hens. He also states that it increases the amount of water drunk by the birds, but appears to have little or no influence on feed consumption, body weight, or production. It does, however, show a tendency to lower mortality and to contribute toward better health and condition of the birds. It was found to improve milkless rations for growing chicks. In fattening trials, rations containing as much as 10 percent of cane molasses gave slightly better gains with little more feed consumption than rations not containing molasses.

The Hawaii Agricultural Experiment Station undertook to determine the value of cane molasses in rations for chicks, growing pullets and cockerels, and for crate fattening of quality-market poultry.

¹ Henry, W. A., and Morrison, F. B. Feeds and Feeding. Ed. 18. 770 p., illus. 1923. (Page 189 cited.)

² Winter, A. R. Cane Molasses for Poultry. Poultry Science 8:369-373.

COMPOSITION OF CHICK AND GROWING RATIONS

The following rations were used in the station experiments:

Lot 1. Commercial scratch, commercial mash plus 1 percent of cod-liver oil, and 5 percent of molasses in the mash.

Lot 2. Commercial scratch, commercial mash, plus 1 percent of cod-liver oil, and 7 percent of molasses in the mash.

Lot 3. Commercial scratch, commercial mash, plus 1 percent of cod-liver oil, and 10 percent of molasses in the mash.

Lot 4. Commercial scratch, commercial mash, plus 1 percent of cod-liver oil, but no molasses in the mash.

In addition to the above-mentioned feeds, grit, bone, oyster shells, charcoal, and chopped green alfalfa were fed in open hoppers.

The average composition and nutritive ratio of the cane molasses used was fat, 0; carbohydrates, 63.2; protein, 2.3; ash, 6.3; water, 20; Nutritive ratio, 1:58.5.

COST OF FEED

At the prevailing local market prices, the cost per pound of the feeds used was as follows:

Feed	Cost
Chick mash	\$0.027—0.320
Growing mash .....	.023— .265
Scratch feed .....	.019— .220
Alfalfa .....	.005
Grit .....	.015
Poultry bone .....	.035
Charcoal .....	.035— .500
Oyster shells .....	.015— .200
Molasses .....	.005— .008
Cod-liver oil .....	.128

PERIOD COVERED BY THE EXPERIMENT

The experiment from which the data used in this circular were obtained began April 18, 1929, and continued through to July 5, 1932. Several experiments, each of 13 weeks, were made and all gave practically the same results. The cost of feed is based upon cost in the last trial in 1932.

BROODING MANAGEMENT

HOUSING

Two types of brooder houses were used in this investigation—the long, continuous brooder house and the colony brooder house (fig. 1 and 2). The colony houses were 10 feet wide and 12 feet long, and had a capacity of 250 chicks. They were of the shed-roof type, built entirely of wood, and were made mosquito-proof as a preventive measure in the control of sorehead (fowl pox). The houses were connected with brooder runs, 2½ feet above the ground, to reduce the possibility of crowding. Two types of runs were

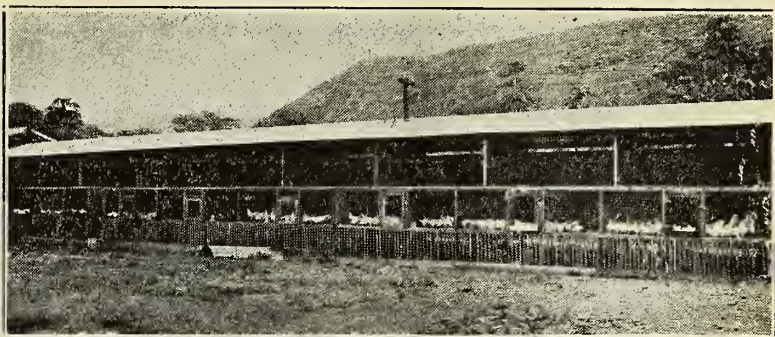


Figure 1.—Continuous brooder house, showing, in separate pens, the birds used in this experiment. A board ceiling is underneath the metal roof.

used. One type had a floor of one-half inch mesh hardware wire placed on removable frames (fig. 2), and the other had a concrete floor, and a roof covered with roofing paper (fig. 3). The runs were 12 feet wide, 20 feet long, and 3 to 7 feet high, and were made mosquito-proof.

In the continuous type of brooder house each room was 9 feet 9 inches long, and 9 feet 10 inches wide. The upper half of the front was screened with $1\frac{1}{2}$ -inch mesh poultry wire. Each room was connected with a run 6 feet 2 inches wide and 7 feet 10 inches long, and had a floor of one-half inch mesh hardware wire. The roof was of sheet iron with a board ceiling underneath (fig. 1).

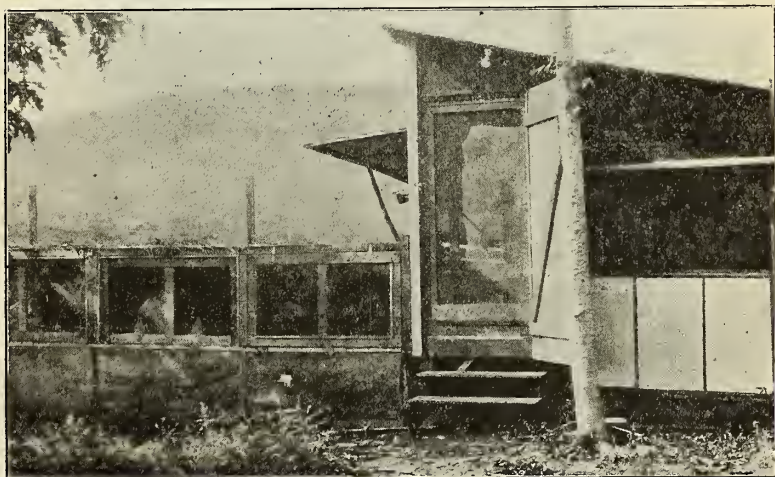


Figure 2.—A colony brooder house with run attached. The floor of the run is of one-half inch mesh hardware wire on removable frames.

TEMPERATURES

All the chicks were brooded with electric brooders (fig. 4). The brooding temperatures were 100° F. for the first day, 99° for the second day, 98° for the third day, 95° for the seventh day, 90° for the fourteenth day, 90° for the twenty-first day (hover, 9 inches above the floor), and 85°



Figure 3.—Brooder house with run attached. The floor of the run is of concrete and the run is covered with a roof.

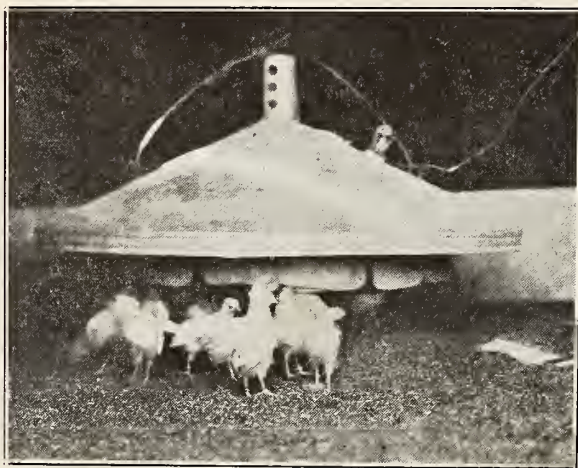


Figure 4.—An electric brooder. Note that the brooder is raised above the floor to reduce the temperature and to increase the ventilation.

for the twenty-eighth day (hover, 12 inches above the floor). After the fourth week the roosts were set in place, and by the fifth week the birds were roosting without artificial heat, except on unusually cold nights.

WEIGHING THE CHICKS

The chicks were weighed on a gram scale at 7-day intervals between 7.30 and 8.30 o'clock in the morning before they were fed. The average of the weights of 20 chicks was taken as the approximate weight per chick at each weighing. The weights are given in Table 1.

TABLE 1.—AVERAGE WEIGHT OF CHICKS AT THE BEGINNING AND AT WEEKLY INTERVALS FOR 13 WEEKS.

	Lot 1		Lot 2		Lot 3		Lot 4	
	Fed 5 percent molasses		Fed 7 percent molasses		Fed 10 percent molasses		(control) No molasses	
	lbs.	Grams	lbs.	Grams	lbs.	Grams	lbs.	Grams
Initial weight .....	.08*	35.03	.07	33.73	.07	33.25	.08	33.93
First week .....	.17	75.57	.14	62.37	.14	63.10	.14	64.50
Second week .....	.23	104.87	.23	102.06	.22	100.65	.24	107.73
Third week .....	.33	150.28	.31	140.34	.32	145.74	.33	148.87
Fourth week (pullets) ..	.44	197.75	.42	187.92	.38	172.91	.46	209.79
Fourth week (cockerels) ..	.50	226.80	.49	221.40	.48	215.46	.48	218.27
Fifth week (pullets) .....	.54	243.81	.63	283.50	.54	243.81	.60	272.16
Fifth week (cockerels) ..	.68	309.04	.61	277.83	.64	289.17	.63	283.50
Sixth week (pullets) .....	.78	351.54	.75	340.20	.75	340.20	.75	340.20
Sixth week (cockerels) ..	.84	379.89	.86	391.23	.88	396.90	.83	376.49
Seventh week† .....	.98	442.26	.91	411.10	.83	377.08	.79	360.07
Eighth week	1.03	467.80	.98	445.12	.94	428.11	.94	425.25
Ninth week	1.18	532.98	1.14	514.84	1.10	497.96	1.13	510.30
Tenth week	1.20	544.32	1.33	601.02	1.20	544.32	1.18	533.89
Eleventh week	1.46	663.16	1.40	635.04	1.39	629.14	1.35	612.36
Twelfth week	1.60	723.49	1.60	725.76	1.48	669.06	1.50	680.40
Thirteenth week	1.91	867.28	1.96	890.42	1.75	793.80	1.78	805.14

* In calculating pounds, grams, costs, etc., the product was carried through to the third decimal and then reduced to two decimals. When the third decimal was greater than 5 it was added to the second decimal (ie. .077 to .08).

† Cockerels removed.

MIXING THE FEED

The molasses was carefully mixed with the mash feed. The amount of mash feed to be used was weighed and the amount of molasses was determined by the percentage given to each lot of chicks. Half the mash was then poured into a large mixing tub and the molasses added. The mixture was thoroughly mixed and then passed through a wire screen to remove all lumps. After the mixture had been screened the rest of the dry mash was added. Fresh mixtures were made every 5 days.

FEEDING

It is desirable to begin feeding chicks when they are 24 to 36 hours old (fig. 5). In the station experiments, feeding began when the chicks were 36 hours old to hasten early yolk absorption, lessen the tendency to over-feed, and eliminate vices. The first feed, chick-sized grit, was placed on clean paper or on paper plates before the chicks. For the first week all drinking water was heated before it was given to the chicks. After their first feed of grit and water, the chicks were given commercial chick mash on paper at two-



Figure 5.—Chicks ready for their first feed at 24 to 36 hours after hatching.

hour intervals on the first day. On the second day the mash was fed in small open hoppers accessible to the chicks all day.

The scratch feed was fed for the first time on the tenth day and only at the last feeding in the afternoon. On the twentieth day, the scratch feed was fed morning and night in amounts that were eaten in an hour. On the seventh day, green feed in the form of chopped green alfalfa was fed twice daily, and charcoal, oyster shells, grit, and bone were fed in open hoppers. At twelve weeks, scratch feed was fed three times daily. At the beginning of the seventh week the chick-starting mash was changed to growing mash. Separate records of data on feed consumption, feed cost, and rate of gain, were kept for the first six weeks and from the seventh through the thirteenth week.

VACCINATION

At nine weeks of age the pullets were successfully vaccinated against chicken pox. The cockerels had been

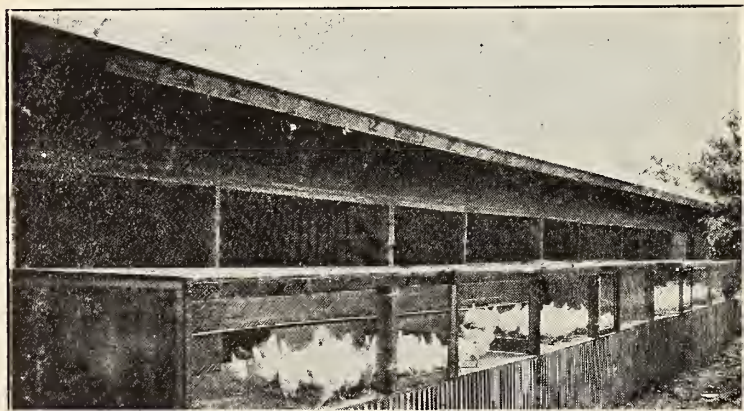


Figure 6.—Laying house with sun porch attached. The pullets were transferred to this house after being immunized against chicken pox.

removed from the experimental pens at seven weeks. After vaccination the birds were moved to the long brooder house (fig. 1), and later transferred to the laying house (fig. 6).

GROWTH, FEED CONSUMPTION, AND PRODUCTION COSTS

As shown in Table 1 (page 5), the chicks fed 5 percent and 7 percent, respectively, of molasses were heavier at the end of 13 weeks than were the chicks on the 10 percent molasses ration and the control lot, which received no molasses.

Tables 2 and 3 give the gains per chick for 13 weeks.

TABLE 2.—GAIN PER CHICK PER WEEK FOR THIRTEEN WEEKS

	Lot 1		Lot 2		Lot 3		Lot 4	
	Fed 5 percent molasses		Fed 7 percent molasses		Fed 10 percent molasses		(control) No molasses	
	lbs.	Grams	lbs.	Grams	lbs.	Grams	lbs.	Grams
First week .....	.09	41.55	.06	28.67	.07	29.85	.07	30.57
Second week .....	.06	28.30	.08	39.69	.08	37.56	.10	43.23
Third week .....	.10	45.41	.08	38.28	.08	45.09	.09	41.14
Fourth week (pullets) ..	.11	47.47	.11	47.58	.06	37.17	.13	60.92
Fourth week (cockerels) ..	.17	76.52	.18	81.06	.15	69.72	.15	69.40
Fifth week (pullets) ..	.10	45.41	.21	95.58	.16	70.89	.14	62.37
Fifth week (cockerels) ..	.18	82.24	.12	56.43	.16	73.71	.13	65.23
Sixth week (pullets) ..	.24	107.73	.13	56.70	.21	96.39	.15	68.04
Sixth week (cockerels) ..	.16	70.85	.25	113.40	.24	107.73	.21	92.99
Seventh week* .....	.20	90.72	.16	70.90	.08	36.88	.04	19.87
Eighth week .....	.06	25.24	.08	34.02	.11	51.03	.14	63.18
Ninth week .....	.14	65.18	.15	69.72	.16	70.85	.19	85.05
Tenth week .....	.03	11.34	.19	86.18	.10	46.36	.05	43.59
Eleventh week .....	.26	118.84	.08	34.02	.19	84.82	.17	78.47
Twelfth week .....	.13	60.33	.20	90.72	.09	39.92	.15	68.04
Thirteenth week .....	.32	143.79	.36	164.66	.28	124.74	.28	124.74

* Cockerels removed.

TABLE 3.—PERCENTAGE GAIN PER CHICK PER WEEK FOR THIRTEEN WEEKS

	Lot 1		Lot 2		Lot 3		Lot 4	
	Fed 5 percent molasses		Fed 7 percent molasses		Fed 10 percent molasses		(control) No molasses	
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
First week	13.12	9.35	9.72	9.98				
Second week	8.94	12.95	12.23	14.11				
Third week	14.34	12.49	12.22	13.28				
Fourth week (pullets) † ..	15.22	16.17	8.95	19.88				
Fourth week (cockerels) ..	22.19	22.54	19.18	20.26				
Fifth week (pullets)	14.33	30.54	23.24	20.36				
Fifth week (cockerels)	23.84	15.78	20.26	17.71				
Sixth week (pullets)	34.03	18.49	31.25	22.21				
Sixth week (cockerels)	20.10	31.71	29.62	25.82				
Seventh week ‡	17.68	12.87	8.10	4.29				
Eighth week	4.92	6.18	11.30	14.05				
Ninth week	12.66	12.69	15.60	18.24				
Tenth week	2.20	15.66	10.00	5.07				
Eleventh week	23.04	6.18	18.70	16.88				
Twelfth week	11.70	16.49	8.80	14.63				
Thirteenth week	27.97	29.92	27.50	26.83				

† Cockerels and pullets weighed separately.

‡ Cockerels removed.

The gains per chick per week and the percentage gains were greater for the 5 and the 7 percent molasses groups; consequently, the final weights also were greater. The percentage gains are shown graphically in figures 7 and 8. The pounds of feed required per pound of gain and the cost per chick per pound of gain are shown in Tables 4, 5, 6, and 7, and also graphically in figures 9 and 10.

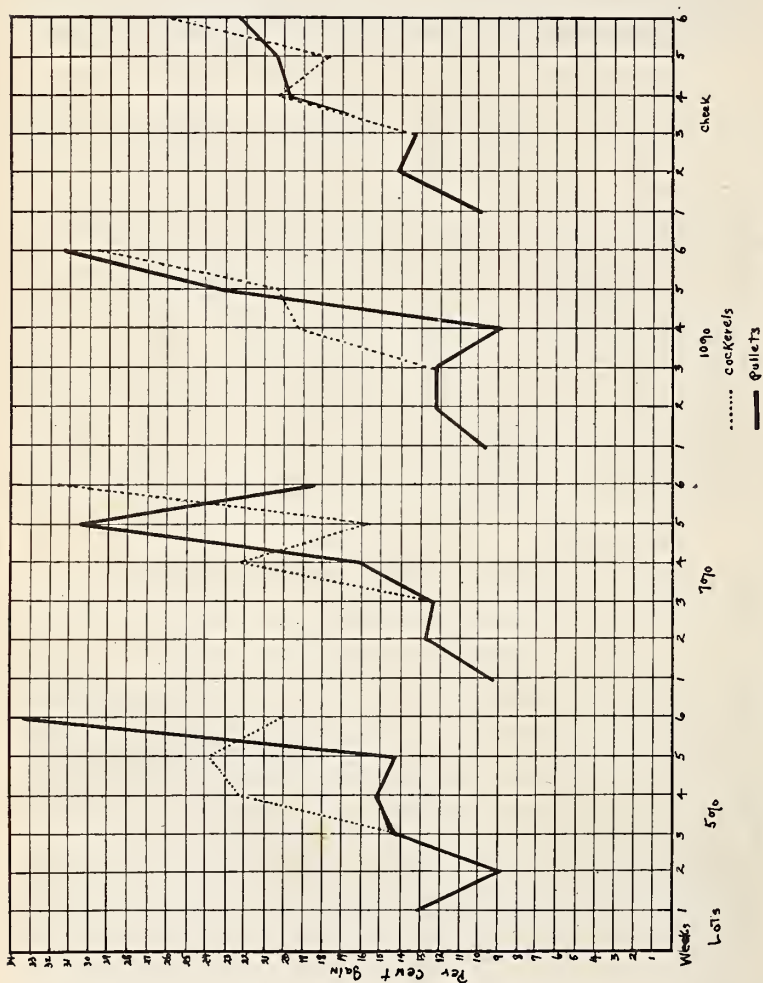


Figure 7.—Percent gain per chick per week from the first through the sixth week.

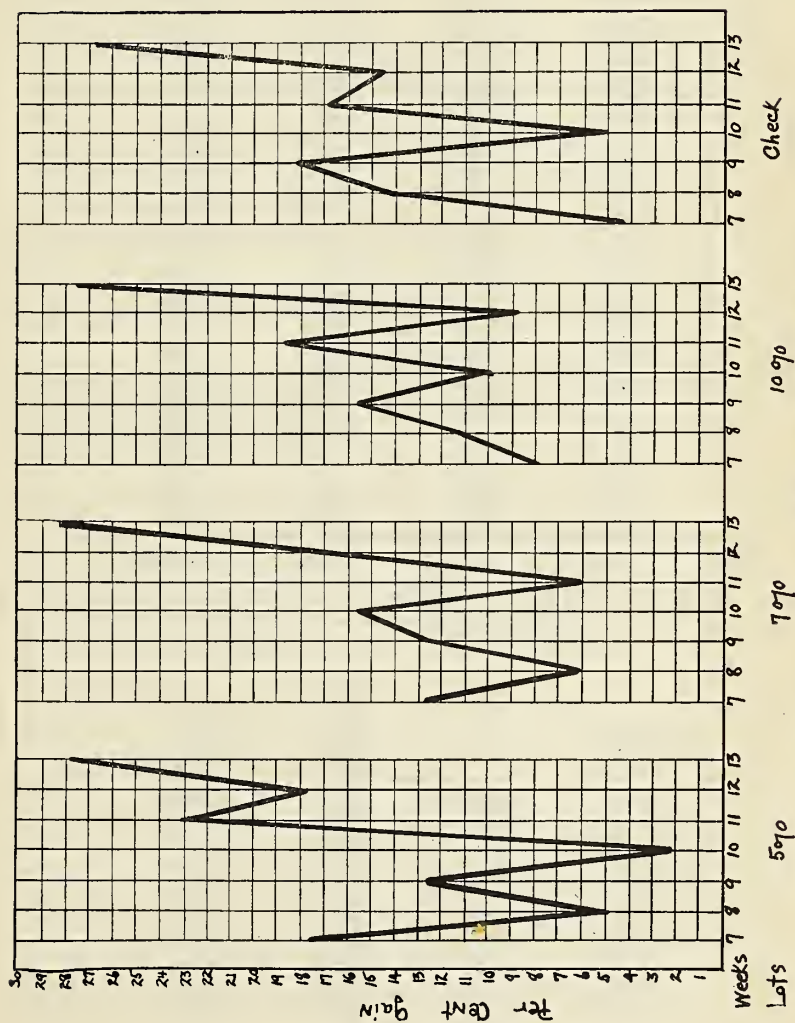


Figure 8.—Percent gain per chick per week from the seventh through the thirteenth week.

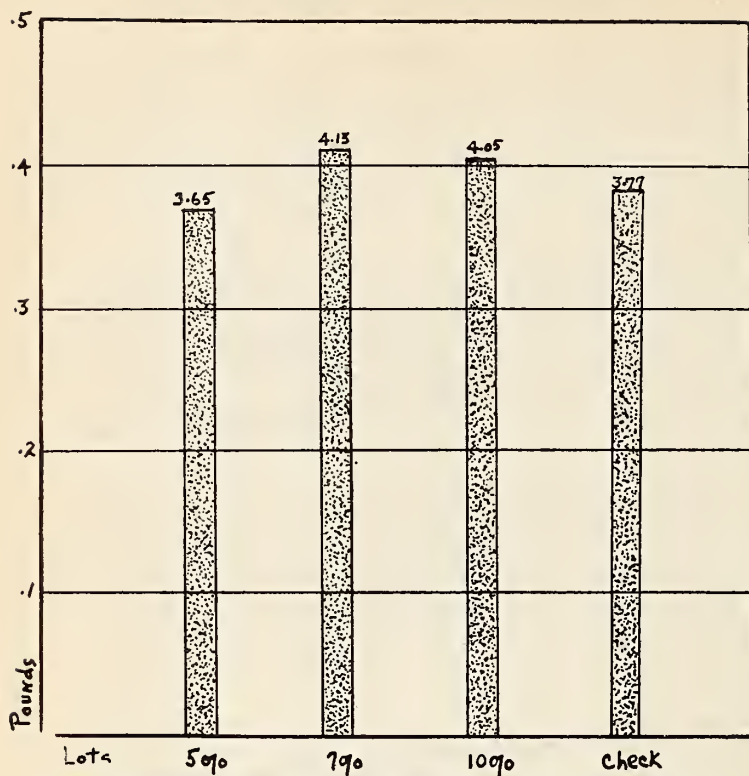


Figure 9.—Pounds of feed required per pound of gain for the first six weeks.

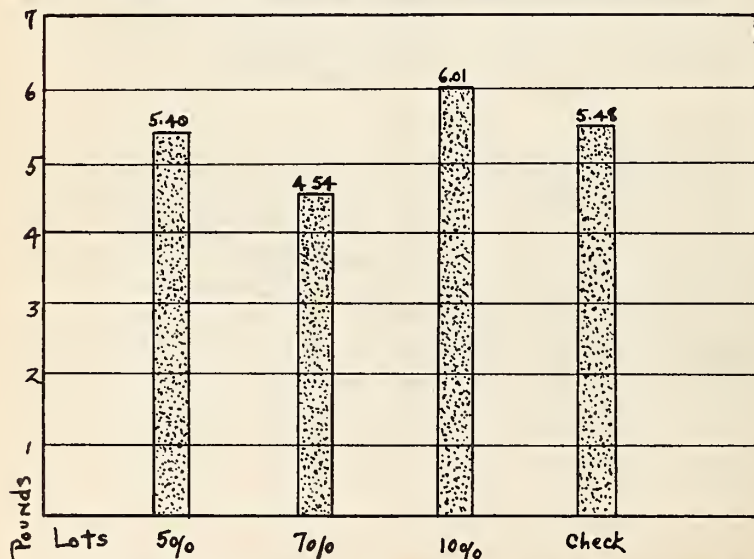


Figure 10.—Pounds of feed required per pound of gain from the sixth through the thirteenth week.

TABLE 4.—POUNDS OF FEED REQUIRED PER POUND OF GAIN FOR THE FIRST SIX WEEKS.

	Total feed consumed Pounds	Total gain Pound	Amount of feed per pound of gain Pounds
Lot 1 (fed 5 percent molasses).....	2.55	0.70	3.65
Lot 2 (fed 7 percent molasses).....	2.79	.68	4.13
Lot 3 (fed 10 percent molasses).....	2.74	.68	4.05
Lot 4 (control; no molasses).....	2.55	.68	3.77

TABLE 5.—COST PER CHICK PER POUND OF GAIN FOR THE FIRST SIX WEEKS.

	Total gain Pound	Total cost	Cost per pound of gain
Lot 1 (fed 5 percent molasses).....	0.70	\$0.07	\$0.11
Lot 2 (fed 7 percent molasses).....	.68	.08	.12
Lot 3 (fed 10 percent molasses).....	.68	.07	.11
Lot 4 (control; no molasses).....	.68	.07	.11

TABLE 6.—POUNDS OF FEED REQUIRED PER POUND OF GAIN FROM THE SIXTH THROUGH THE THIRTEENTH WEEK.

	Total feed consumed Pounds	Total gain Pounds	Amount of feed per pound of gain Pounds
Lot 1 (fed 5 percent molasses).....	6.14	1.14	5.40
Lot 2 (fed 7 percent molasses).....	5.50	1.21	4.54
Lot 3 (fed 10 percent molasses).....	6.01	1.00	6.01
Lot 4 (control; no molasses).....	5.62	1.03	5.48

TABLE 7.—COST PER CHICK PER POUND OF GAIN FROM THE SIXTH THROUGH THE THIRTEENTH WEEK.

	Total gain Pounds	Total cost	Cost per pound of gain
Lot 1 (fed 5 percent molasses).....	1.14	\$0.13	\$0.11
Lot 2 (fed 7 percent molasses).....	1.21	.11	.10
Lot 3 (fed 10 percent molasses).....	1.00	.12	.13
Lot 4 (control; no molasses).....	1.03	.12	.12

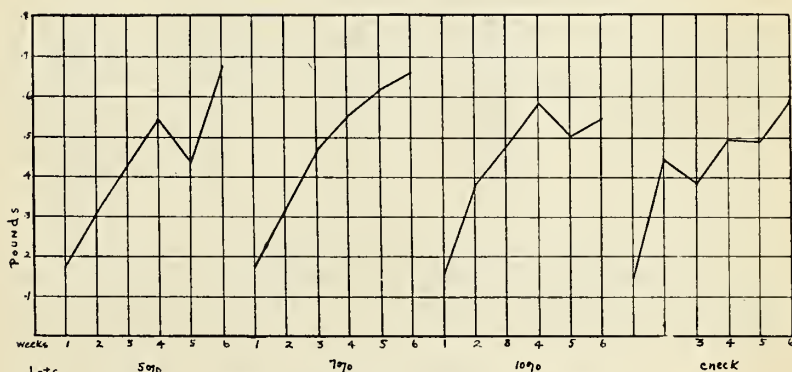


Figure 11.—Feed consumption per chick in pounds for the first six weeks.

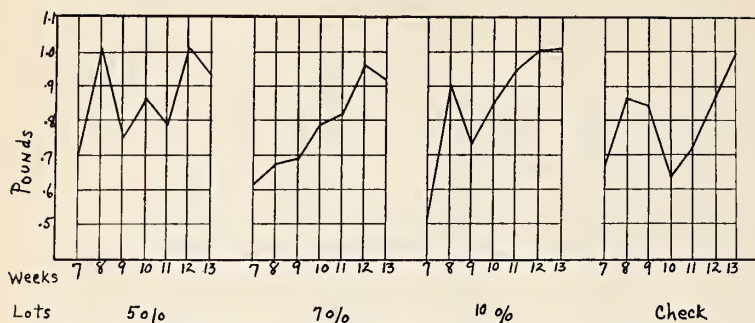


Figure 12.—Feed consumption per chick per week from the seventh through the thirteenth week.

The feed consumption per chick is shown in Table 8 and graphically in figures 11 and 12.

TABLE 8.—TOTAL FEED CONSUMPTION PER CHICK FOR THIRTEEN WEEKS.

	Lot 1 Fed 5 percent molasses Pounds	Lot 2 Fed 7 percent molasses Pounds	Lot 3 Fed 10 percent molasses Pounds	Lot 4 (control) No molasses Pounds
Mash	5.59	5.23	4.92	4.68
Molasses .....	.28	.37	.49	.....
Scratch	1.88	1.80	2.24	2.34
Alfalfa .....	.56	.47	.76	.56
Oyster shells .....	.13	.12	.05	.10
Bone .....	.12	.08	.17	.11
Grit .....	.12	.15	.10	.12
Charcoal .....	.02	.05	.09	.06

The total feed cost per chick for the thirteen weeks is given in Table 9.

TABLE 9.—TOTAL FEED COST PER CHICK FOR THIRTEEN WEEKS.

	Lot 1 Fed 5 percent molasses	Lot 2 Fed 7 percent molasses	Lot 3 Fed 10 percent molasses	Lot 4 (control) No molasses
Mash	\$0.15340	\$0.14300	\$0.13660	\$0.13430
Molasses .....	.00177	.00220	.00327	.....
Scratch .....	.03590	.03140	.04343	.04603
Alfalfa .....	.00281	.00227	.00379	.00177
Oyster shells .....	.00205	.00132	.00571	.00128
Bone .....	.00375	.00223	.00448	.00289
Grit .....	.00205	.00174	.00118	.00166
Charcoal .....	.00123	.00153	.00271	.00162
Total	0.20296	0.18569	0.20117	0.18955

It cost approximately 20 cents to feed a chick on 5 percent of molasses; 18½ cents on 7 percent of molasses; 20 cents on 10 percent of molasses; and 19 cents when no molasses was added to the ration.

MORTALITY

Mortality, due to coccidiosis, for the thirteen weeks was 2.7 percent in the lot fed 7 percent of molasses; 6.9 percent in the lot fed 5 percent of molasses; 9.1 percent in the

lot fed 10 percent of molasses; and 12.1 percent in the control lot (figs. 13 and 14).

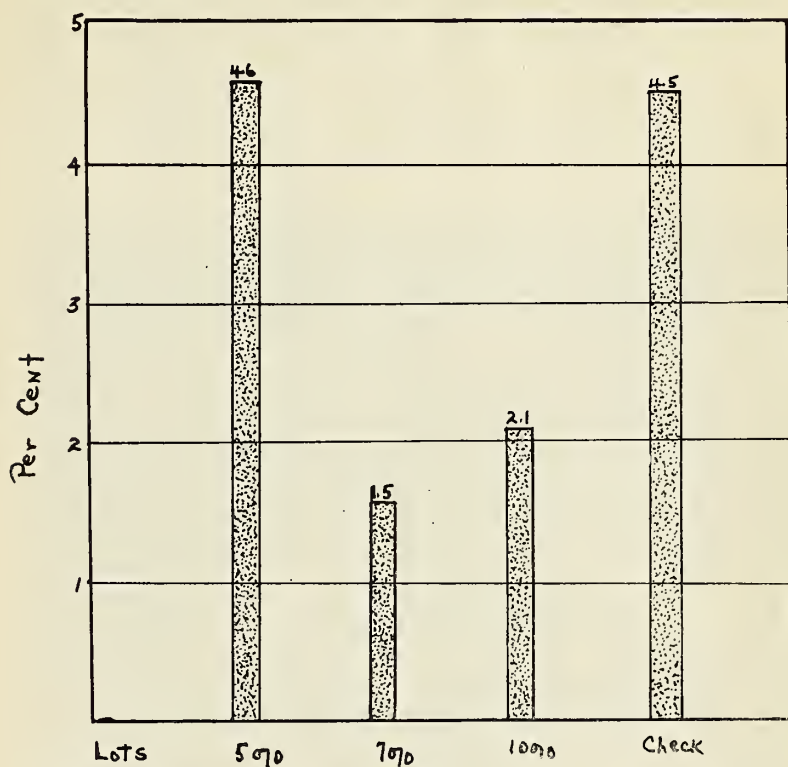


Figure 13.—Percentage of mortality in each lot of chicks for the first six weeks.

FATTENING BROILERS AND HENS

Single Comb White Leghorn, Rhode Island Red, Barred Plymouth Rock, and Black Australorp broilers, varying from 1 to 2½ pounds, and Single Comb White Leghorn and Rhode Island Red hens were fed in fattening batteries for 10 days (fig. 15).

Table 10 shows the composition of the fattening rations used.

TABLE 10.—COMPOSITION OF FATTENING RATIONS FED TO BROILERS AND TO HENS*.

Ration No.	Wheat middlings Percent.	Corn meal Percent.	Molasses Percent.
1	40	60	None
2	40	55	5
3	40	50	10
4	40	45	15

* Semi-solid buttermilk was fed to each group.

WEIGHING AND FEEDING

The birds were weighed separately and the average weight also was determined. The birds were grouped ac-

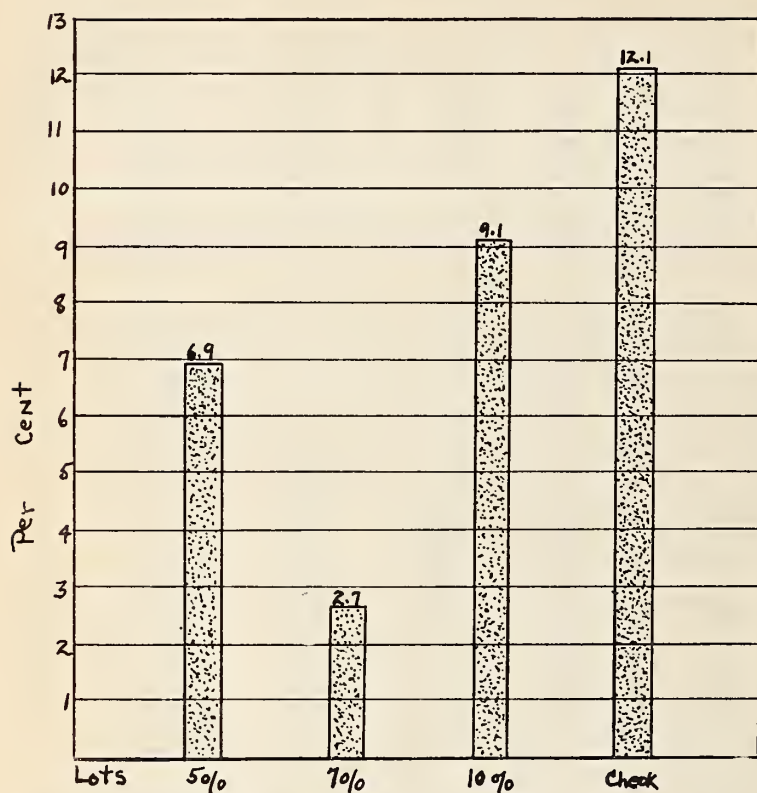


Figure 14.—Percentage of mortality in each lot of chicks from the first through the thirteenth week.

ording to size and weight so that each group would have approximately the same initial weight. All weights were recorded in the morning before feeding was done. Table 11 gives the average gain per bird for the first seven and ten days.

TABLE 11.—AVERAGE GAIN IN WEIGHT PER BIRD FOR SEVEN AND TEN DAYS OF THE EXPERIMENT.

	Light breed cockerels		Heavy breed cockerels		Light breed hens		Heavy breed hens	
	7 days	10 days	7 days	10 days	7 days	10 days	7 days	10 days
	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.
Fed 5 percent molasses	3.50	5.30	3.23	6.60	1.60	3.90	1.40	1.00
Fed 10 percent molasses	3.00	4.60	4.42	8.30	(*)	1.00	(*)	1.90
Fed 15 percent molasses	2.25	3.00	2.80	7.70	0.50	0.81	(*)	0.15
Control (no molasses	4.80	5.90	1.45	5.60	(*)	0.15	(*)	4.80

* Loss in weight, cost not recorded.

Before beginning the experiment the birds were fasted for 24 hours, but had access to water. The molasses was added to the grain mixture and semi-solid buttermilk, diluted with 9 parts of water, was added until the whole was of the consistency of thin mortar.

During the first day the feed remained before the birds for 15 minutes for each of the three meals. At the end of each meal all feed was removed so that the birds would maintain a keen appetite. On the second day the feeding

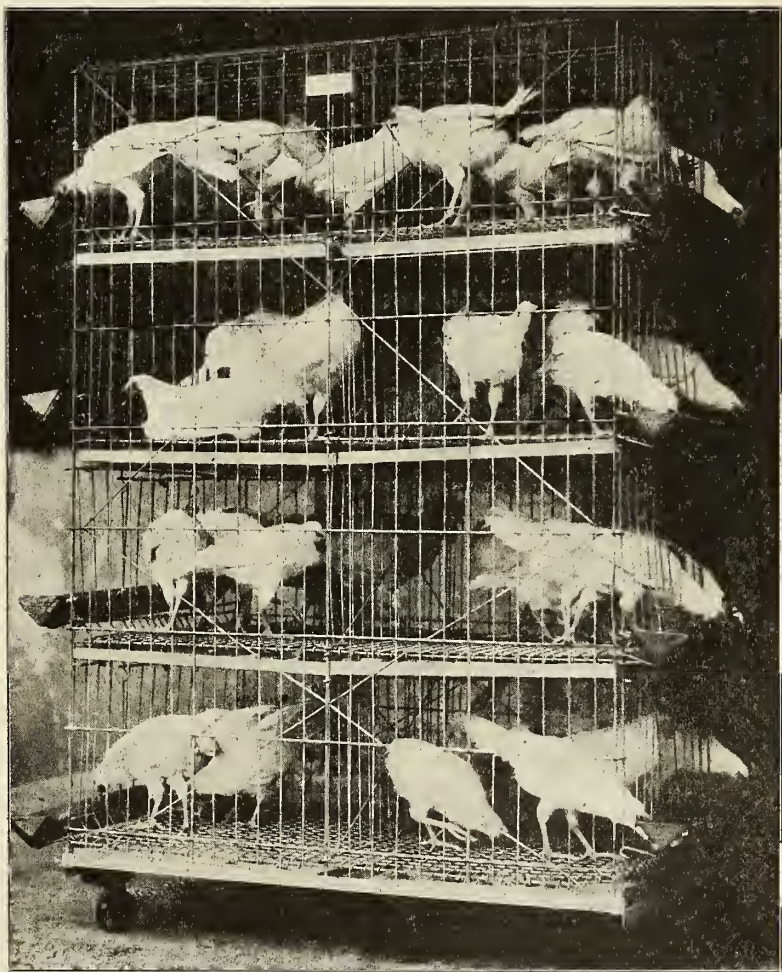


Figure 15.—Single Comb White Leghorn (light breed) cockerels in a fattening battery.

period was increased to 20 minutes three times a day, and on the third day to 30 minutes each time. No water was given throughout the feeding period. The birds remained

in a darkened room except during the feeding periods. The birds were exposed to direct sunlight for 20 minutes each day to protect them against leg weakness during the fattening period. Table 12 records the amount of feed consumed per pound of gain and the cost per pound of gain.

TABLE 12.—POUNDS OF FEED CONSUMED AND COST PER POUND OF GAIN.

	Light		Heavy		Light		Heavy	
	breed cockerels	Cost	breed cockerels	Cost	breed hens	Cost	breed hens	Cost
	Feed		Feed		Feed		Feed	
	Pounds		Pounds		Pounds		Pounds	
Fed 5 percent molasses	5.00	\$0.16	3.68	\$0.13	9.94	\$0.31	49.25	\$1.68
Fed 10 percent molasses	5.94	.16	3.25	.11	.....	(*)	33.81	1.11
Fed 15 percent molasses	4.50	.12	3.25	.11	.....	(*)	.....	(*)
Control (no molasses)	4.18	.13	4.18	.13	13.75	.34	7.00	.24

* Loss in weight, cost not recorded.

CONCLUSIONS

Molasses when fed in amounts not to exceed 7 percent of the mash ration was found to be satisfactory for chicks and for growing pullets and cockerels.

When fed to baby chicks, molasses did not prevent coccidiosis.

Use of fattening rations containing 5, 10, and 15 percent, respectively, of molasses, resulted in economical gains with broilers, but in inefficient production with hens in fattening batteries.